

Human Computer Interaction

CS449 – CS549

Interaction: Economics, HCI Theories, Frameworks

KÜRSAT ÇAĞILTAY

Week-2 Readings — Rubber hits the road

- Landauer Trouble with computers
- Landauer (1995) Excuses, Ch4, pp. 83-113. Trouble with computers: Usefulness, Usability, and Productivity. MIT Press
- Norman - Design of everyday things
- **Norman, D. (2013). The psychology of everyday actions, Ch.2 pp. 37-122. The design of everyday things. Basic Books.**
- Shneiderman-ch3 Guidelines Principles and Theories
- **Shneiderman, B. et.al. (2016). Guidelines, Principles and Theories. pp. 81-120. Designing the User Interface: Strategies for Effective Human-Computer Interaction, 6th Edition**

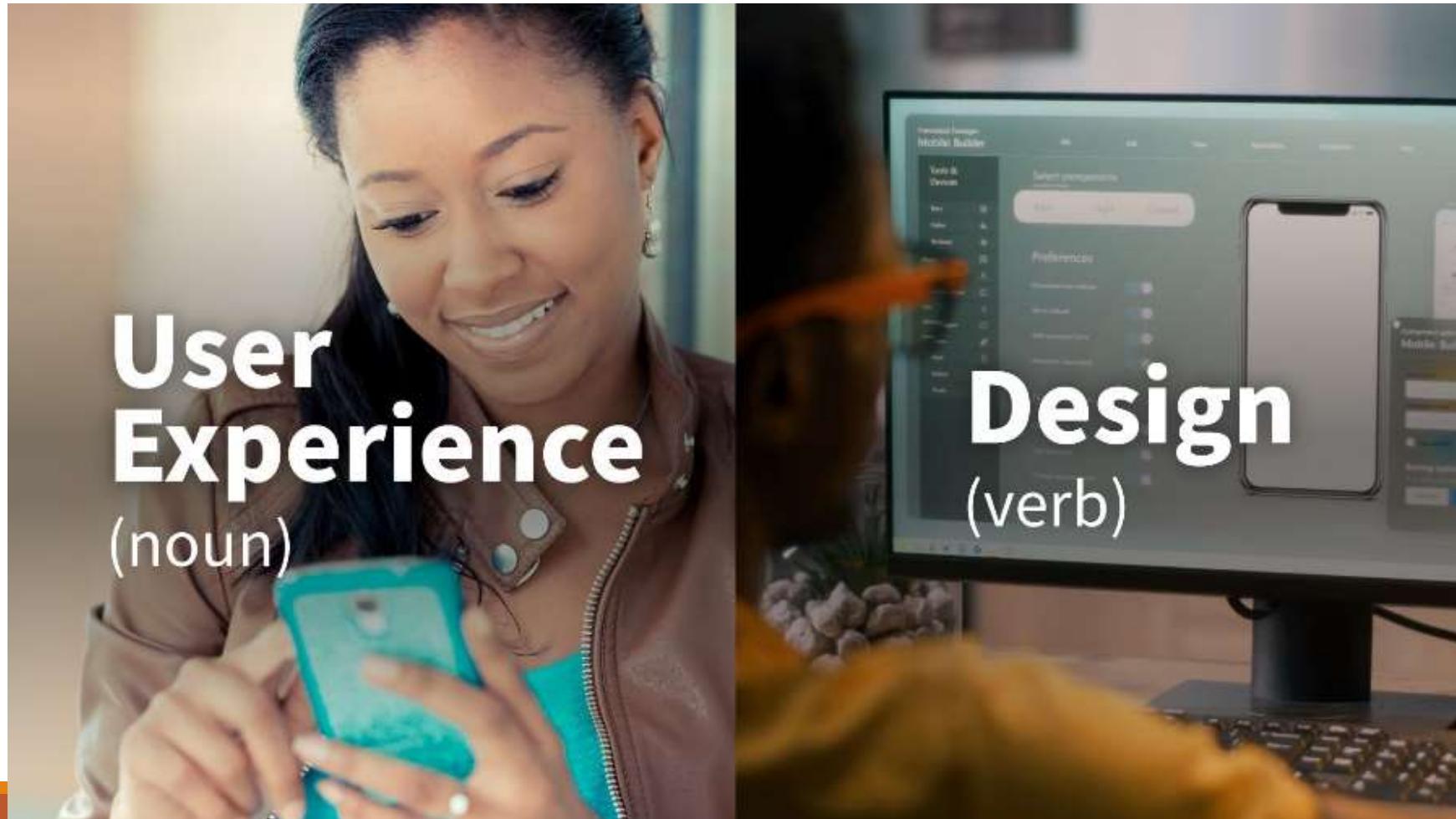
Classroom from my eyes 😊

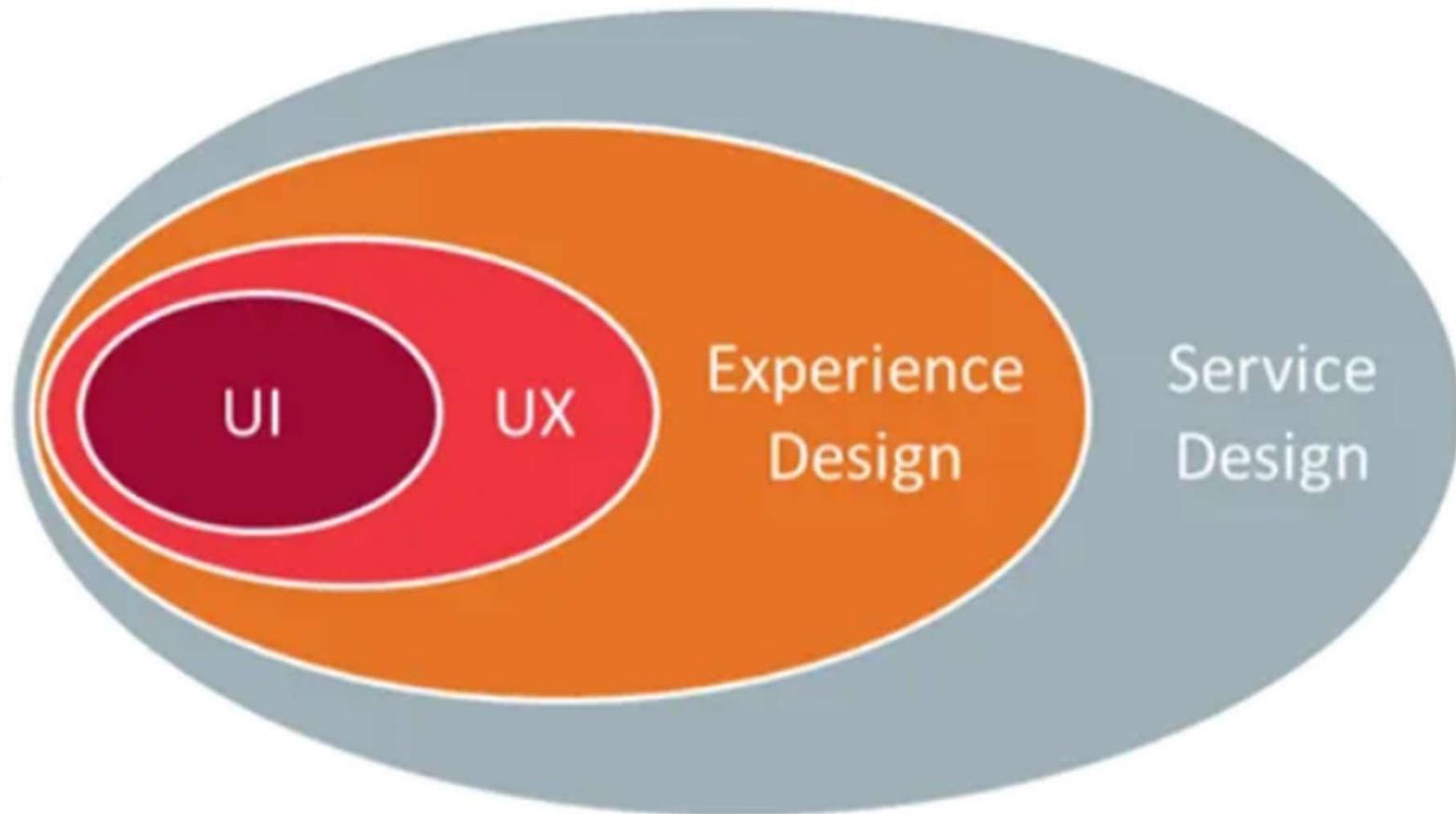


Terminology : HCI, UX, UI, UCD, IxD, CX

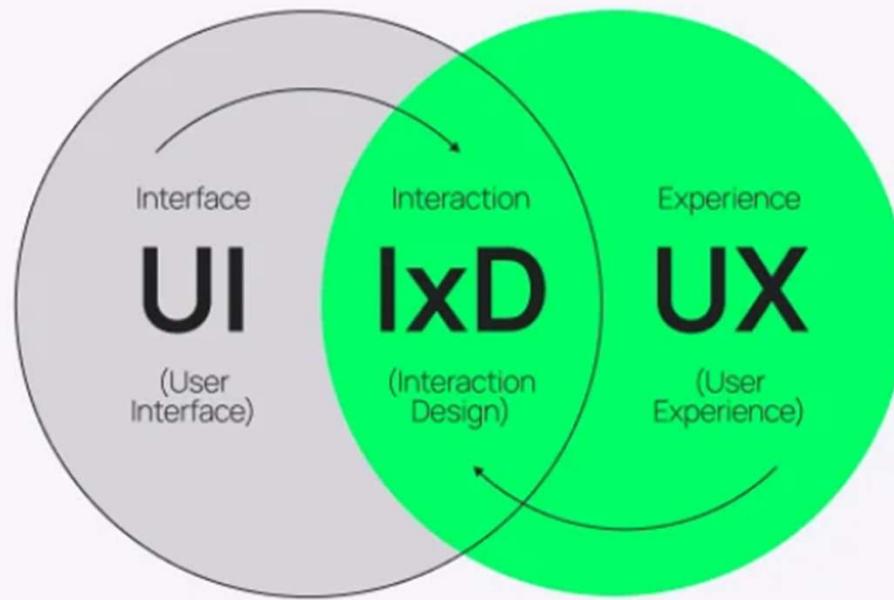
- HCI is broad and more academically focused – It covers everything
- UX – User Experience - practical field, how users feel when interacting with a product or system
- UI – User Interface
- IxD – Interaction Design - practice of designing interactive digital products,
- CX – Customer Experience - entire relationship with a brand
- UCD-User Centered Design

UX and UX Design





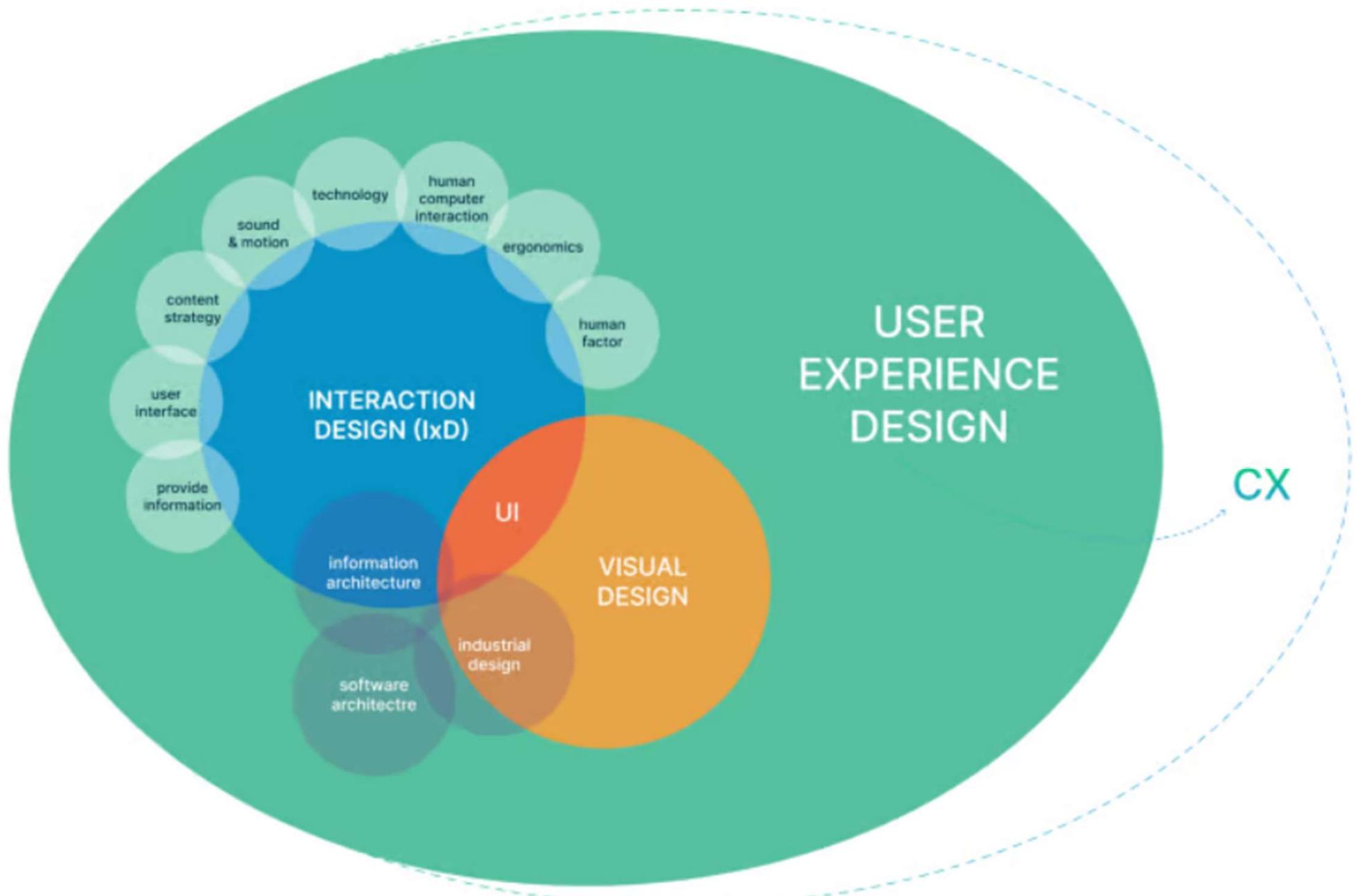
What happens
on the screen



What happens
in front of screen



ComputerHope.com



Week-2 Readings – 1

- Landauer Trouble with computers
- Landauer (1995) Excuses, Ch4, pp. 83-113. Trouble with computers: Usefulness, Usability, and Productivity. MIT Press



Digital Economy is
equivalent to 20%
of global GDP...

Does IT make
Enough Impact?

<https://www.worldbank.org/en/topic/digitaldevelopment/overview#1>

Nobel Economy laureate Robert Solow

"You can see the computer age everywhere but in the productivity statistics."

Productivity/Solow Paradox



Productivity Paradox

Brynjolfsson (1994)

THE PRODUCTIVITY PARADOX OF INFORMATION TECHNOLOGY

Erik Brynjolfsson

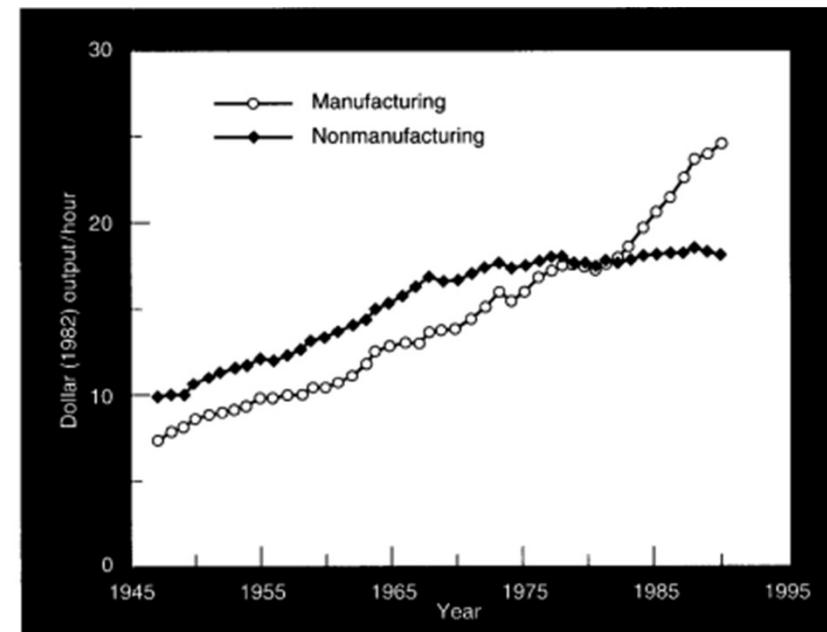
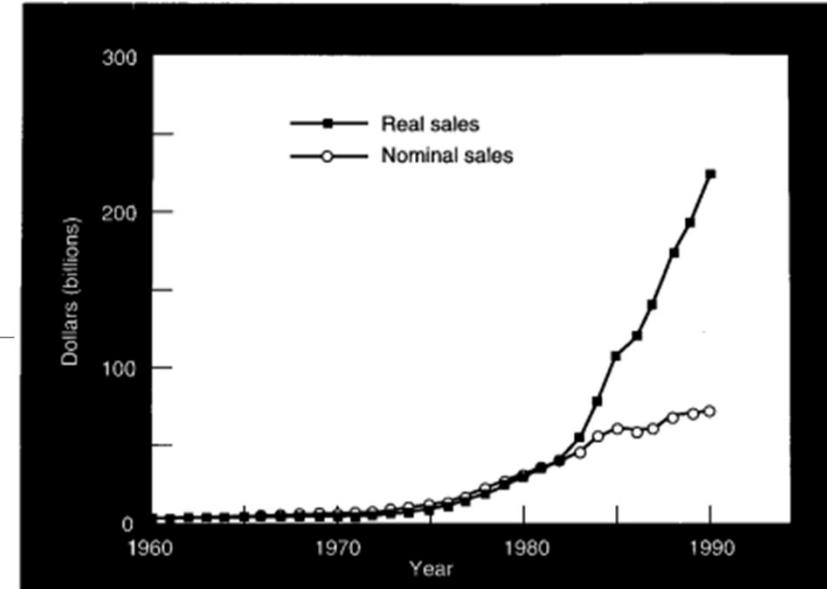
The relationship between information technology (IT) and productivity is widely discussed but little understood. Delivered computing power in the U.S. economy has increased by more than two orders of magnitude since 1970 (Figure 1) yet productivity, especially in the

service sector, seems to have stagnated (Figure 2). Given the enormous promise of IT to usher in "the biggest technological revolution men have known" [29], disillusionment and even frustration with the technology is increasingly evident in statements like "No, computers do not boost productivity, at least not most of the time" [13].

search. After reviewing and assessing the research to date, it appears that the shortfall of IT productivity is as much due to deficiencies in our measurement and methodological tool kit as to mismanagement by developers and users of IT. The research considered in this article reflects the results of a computerized literature search of 30 of the leading journals

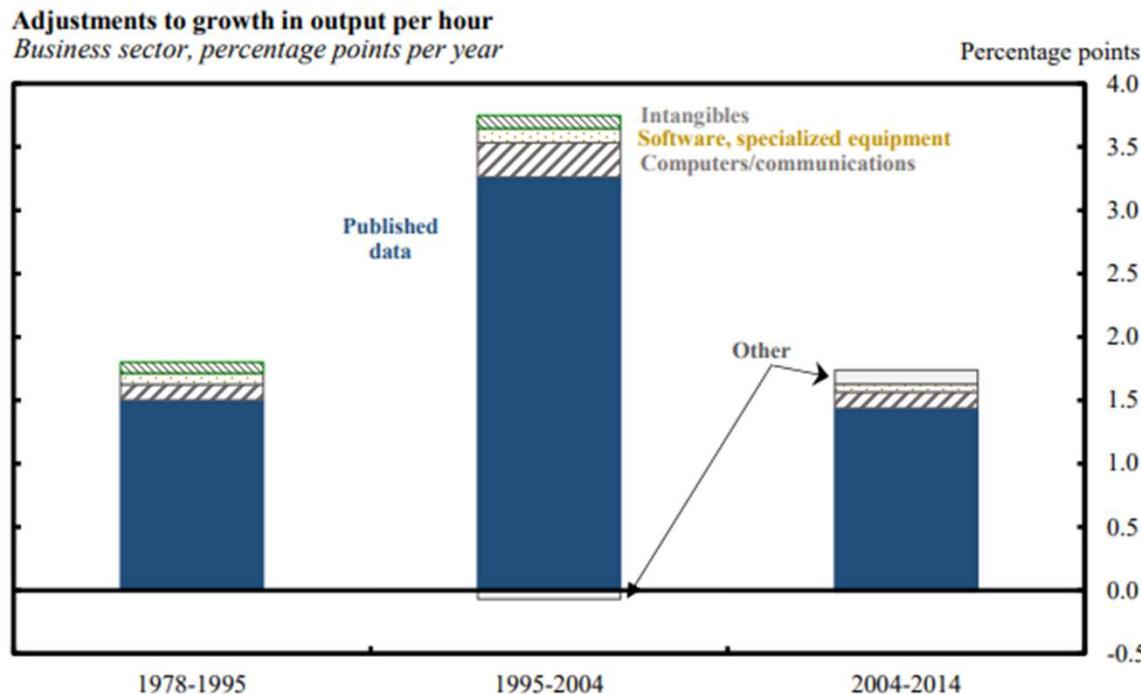
problems assessing the contributions of this critical new technology, and this has been generally interpreted as a negative signal of its value.

The disappointment in IT has been chronicled in articles disclosing broad negative correlations with economywide productivity and information worker productivity. Econometric estimates have also in-



Technology Boom – Declining Productivity

Figure 1: U.S. labor productivity, 1978-2014: published and adjusted



- THE PRODUCTIVITY SLUMP – FACT OR FICTION: THE MEASUREMENT DEBATE
 - Kemal Derviş & Zia Qureshi
 - 2016



Return of the Solow Paradox? IT, Productivity, and Employment in U.S. Manufacturing

Daron Acemoglu, David Autor, David Dorn, Gordon H.
Hanson & Brendan Price

• RESEARCH BRIEFS | NOVEMBER 10, 2020

Understanding and Addressing the Modern Productivity Paradox

ERIK BRYNJOLFSSON, SETH BENZELL, DANIEL ROCK

RB13-2020

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We are in the midst of a technological revolution driven by advances in artificial intelligence (AI). Machines can now accomplish many tasks that only human minds could do as recently as 10 years ago (Perrault et al., 2019), from recognizing images (Russkovsky et al., 2015) and understanding speech (Schmelzer, 2020), to generating plausible text (Brown et al., 2020) and diagnosing diseases as well as or better than human doctors (Esteva et al., 2017). These are not insignificant tasks.

- Brynjolfsson
- 2020 - MIT
- <https://workofthefuture.mit.edu/research-post/understanding-and-addressing-the-modern-productivity-paradox/>



Books

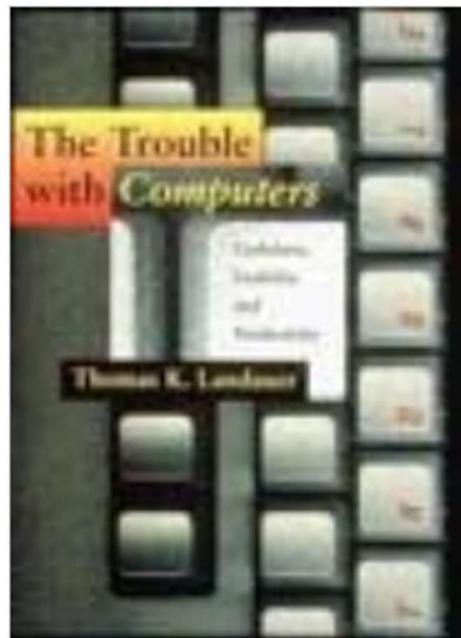
Journals

Open Access

Resources

Give

[Home](#) | [Computer Science](#) | [General](#) | [The Trouble with Computers](#)

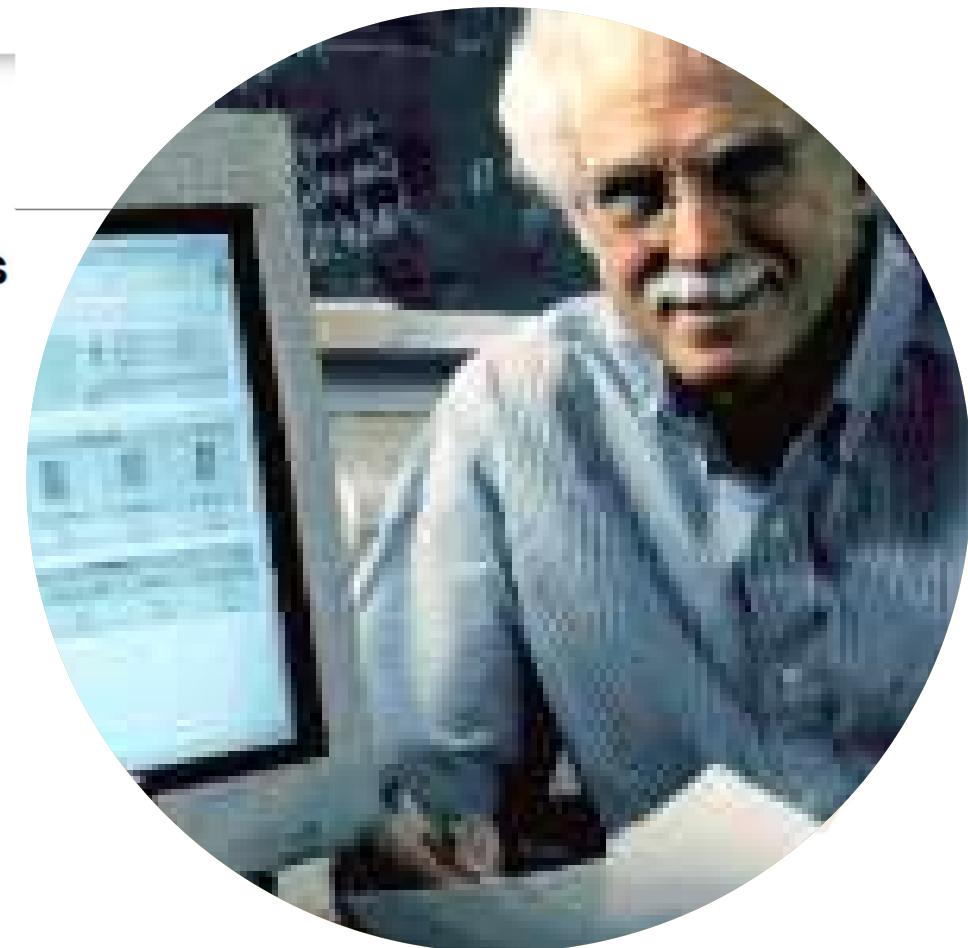


The Trouble with Computers

Usefulness, Usability, and Productivity

By [Thomas K. Landauer](#)

[A Bradford Book](#)



Landauer (1995) Excuses, Ch4, pp. 83-113. Trouble with computers: Usefulness, Usability, and Productivity. MIT Press

The Productivity Paradox (Landauer, 1995)

- Productivity data negatively correlates with IT investments
- Counter arguments are unconvicing
 - Takes time for benefits to accrue
 - Sales success means they must be good! e.g. ATMs
 - Testimonials (weakness of anecdotal evidence)
 - Measurement problems (Don Norman says, dont just measure quantitatively but qualitatively)
 - Satisfaction!

Landauer – one of the reasons

- Usefulness and Usability: The poor design of software
- Phase-1: Automation, has occurred
- Phase-2: Augmentation, is providing difficult
- User-centered systems design is our best hope

Interaction with ATM

- First money, next card?
- First card, next money?
- Cost US \$2-4.5 M
- Your bank's ATM?



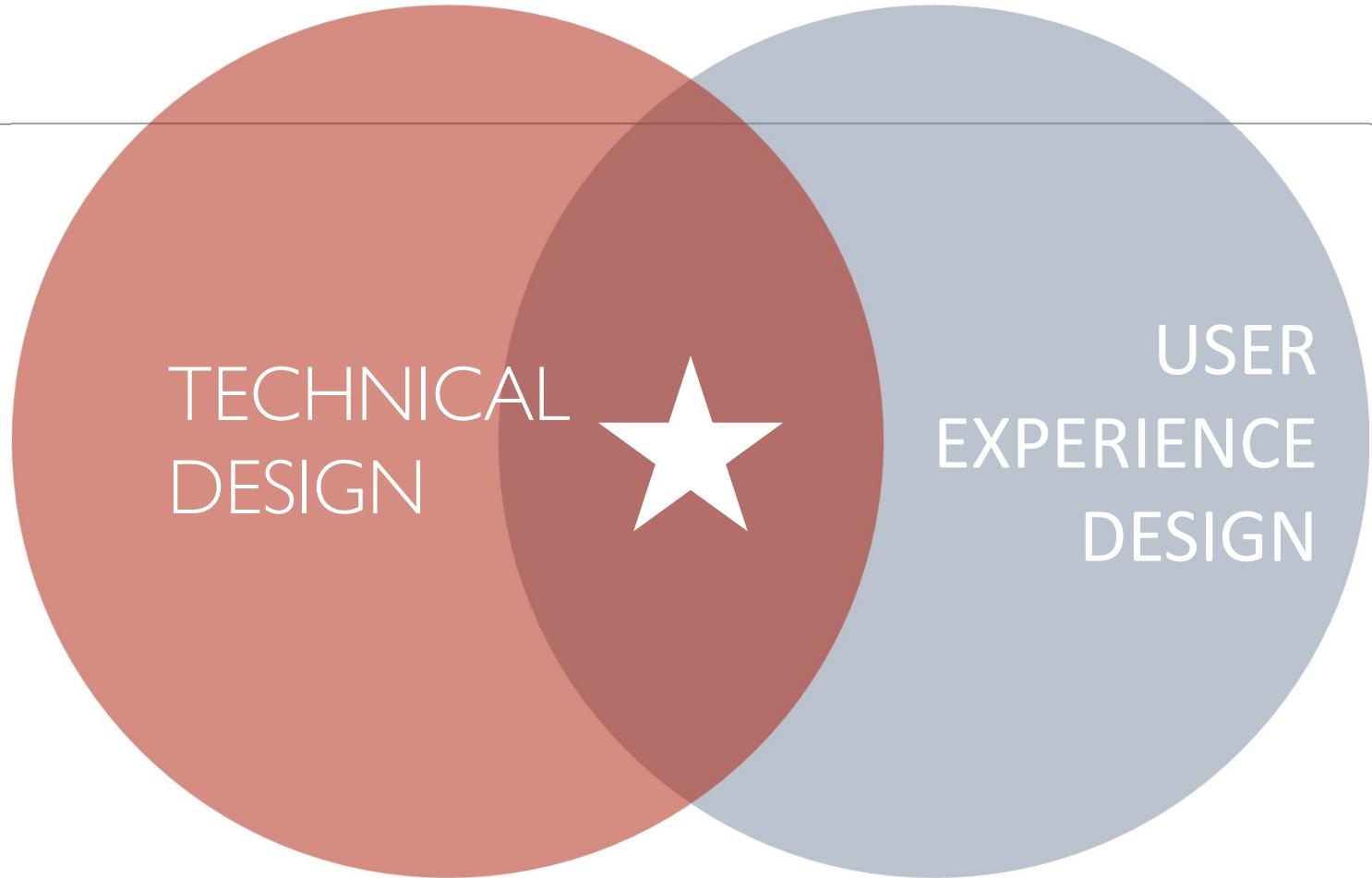
Today

- e-commerce sales of \$738 billion, US and EU,
- potential for 35.26% increase translates to \$260 billion worth of lost orders recoverable by better usability (UX)

Economical Impact of Investing in HCI

- 70% of projects fail due to inability to either attract or retain users
- UX design reduce the time developers need to re-work or ‘fix’ a product by up to 50%.
- For every dollar invested in UX design, a company can expect 100 dollars in return
- study of 408 companies
 - Companies who considered themselves to be fully user-centric, saw their sales increase by 75%

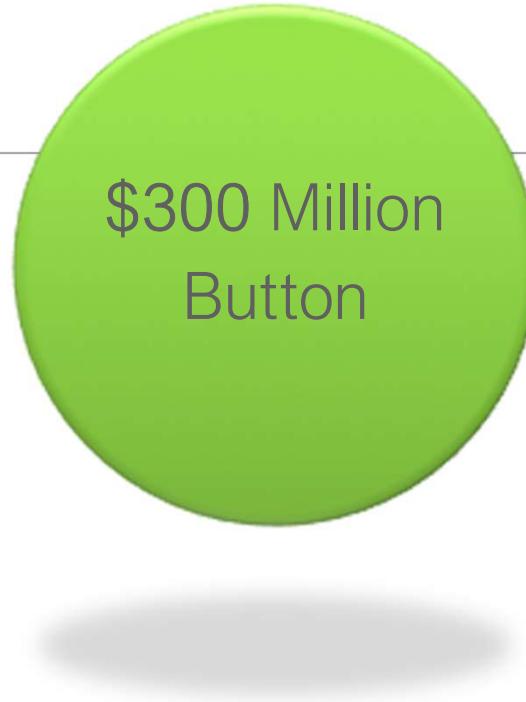
Reference: <https://uxmastery.com/impact-of-investing-in-ux/#:~:text=Even%20small%20investments%20in%20UX,moved%20through%20its%20product%20cycles.>



01-29-09

The \$300 Million “Continue” Button

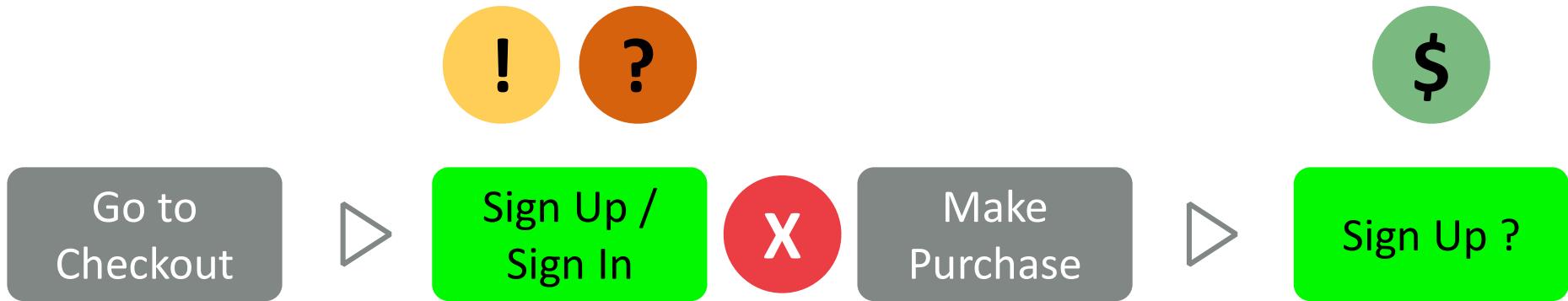
Everyone gets exasperated by bad websites. But we think of those things as tiny annoyances, and assume that users will eventually get what they need. Not true: Tiny mistakes can cost businesses dearly—in fact one poorly designed button might cost \$300 million.



Spool, UIE,
2009

UX design fails when
the solution does not match users’ goals

The Consumer's Goal on an Ecommerce Site

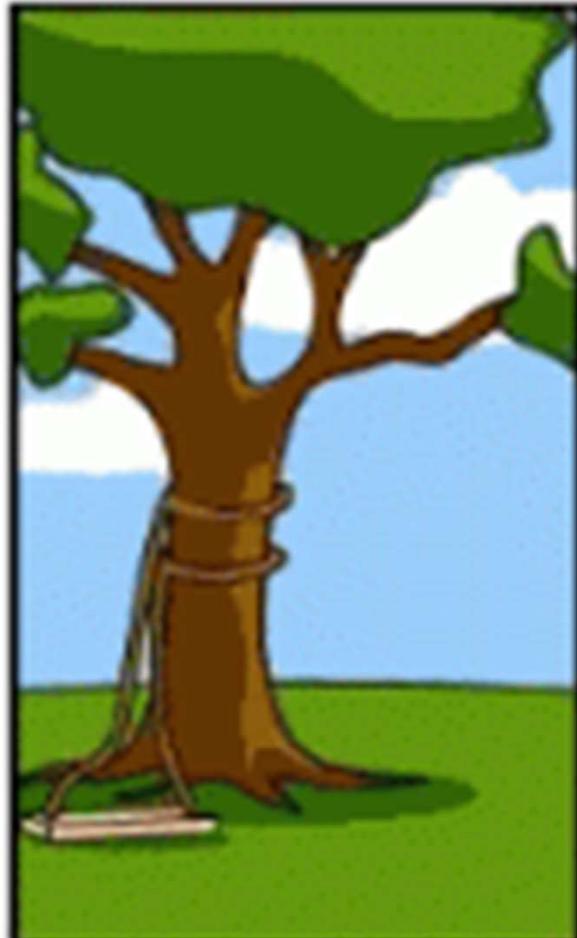


Spool, UIE,
2009

UX design fails when
the solution does not match users' goals



How the Analyst
designed it

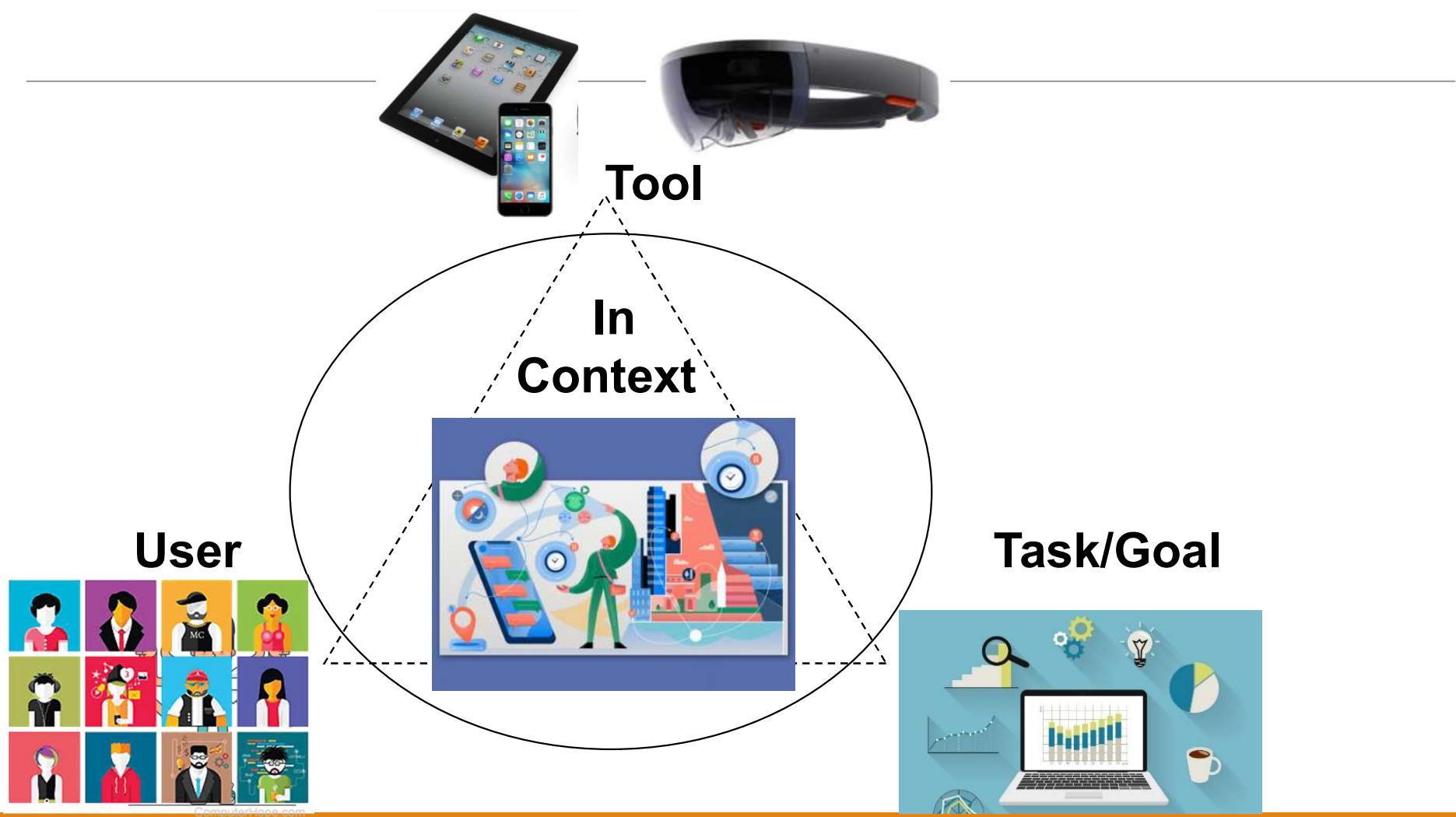


How the Programmer
wrote it



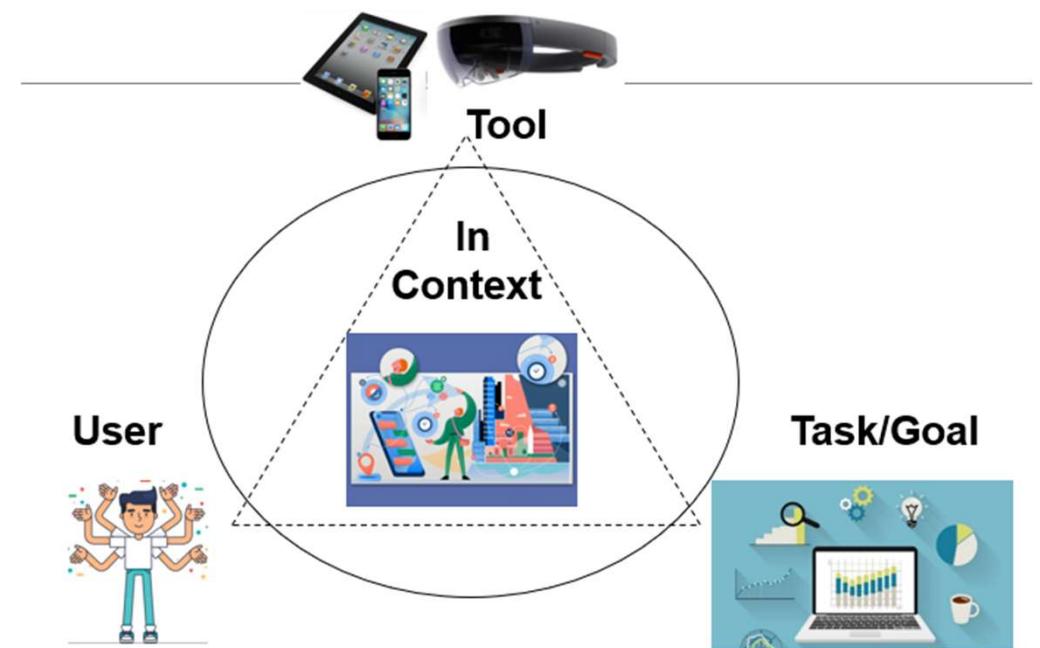
What the customer
really needed

Four Principle components of an HCI System



Lets make an experiment

- Need a Volunteer
- To write and send an e-mail with mobile phone
- Time keeper

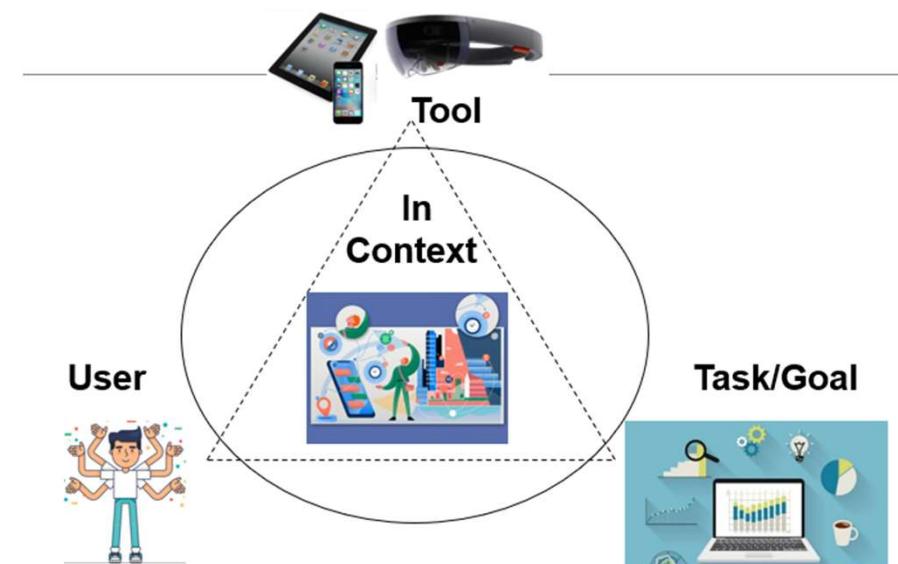


Send me an e-mail

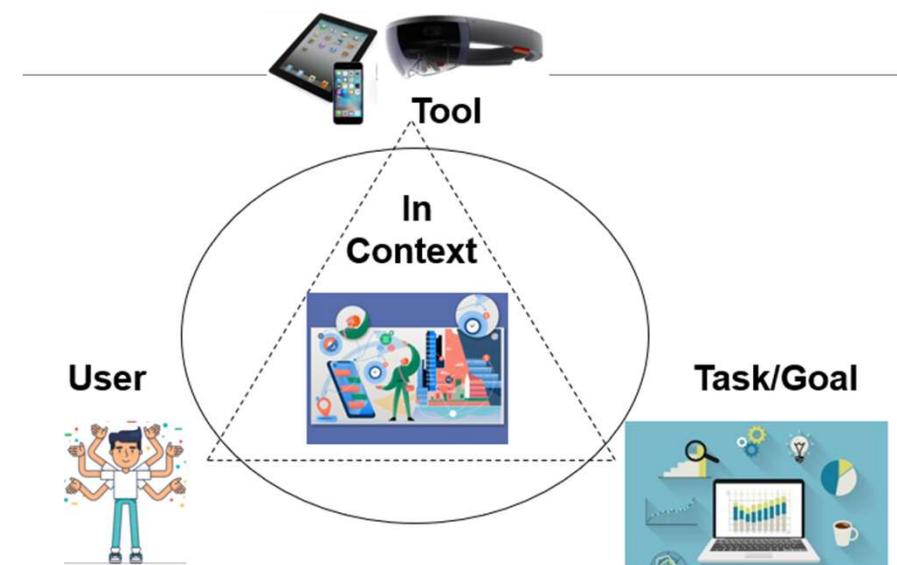
- kursat.cagiltay@sabanciuniv.edu
- Selamlar. Nasılsınız? Bugün hava çok sıcak.

Same test different context-1

- Selamlar. Nasılsınız? Bugün hava çok sıcak.
- Time keeper

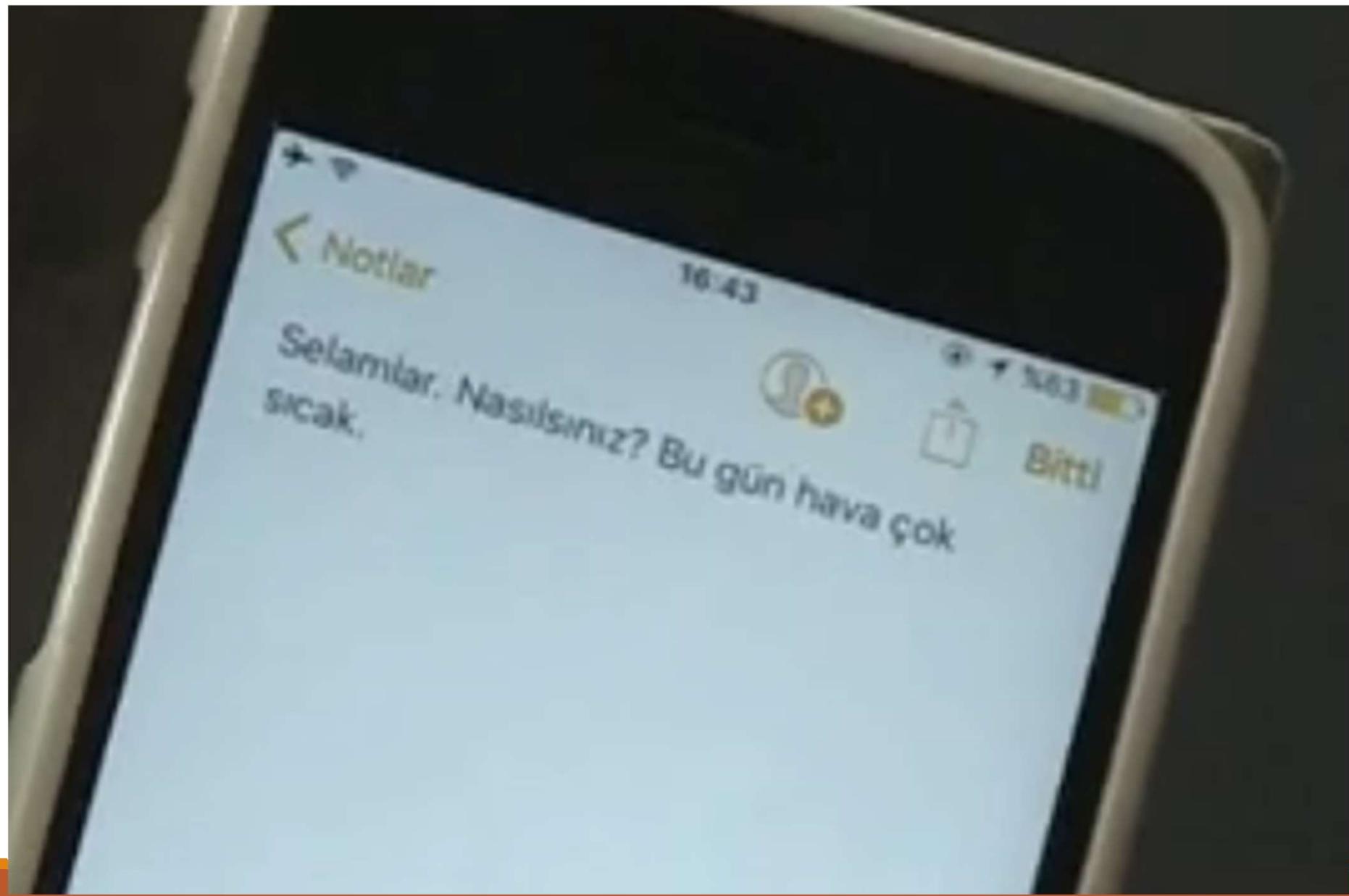


Same test different context-2?





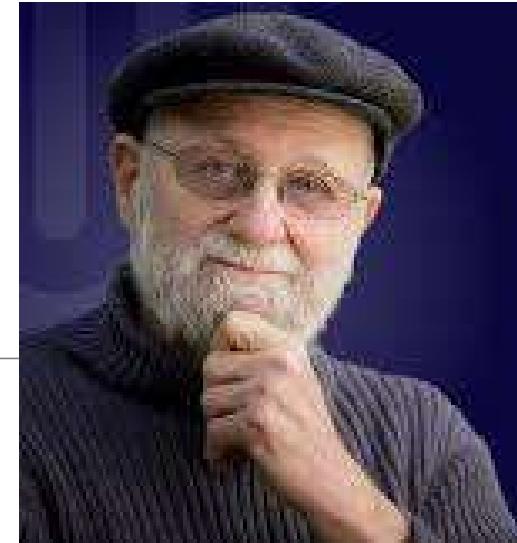
For full interview <https://youtu.be/JSiSYRK6OdY>



Donald Norman

Ch-2 Design of Everyday Things

- MIT – Electrical Engineering
- Mathematical Psychology – Ph.D. - University of Pennsylvania
- Department of Cognitive Science-Univ of California, San Diego
- Cognitive science to Cognitive engineering
- Apple Computer, User Experience Architect
 - Vice President of the Advanced Technology Group
- Nielsen Norman Group



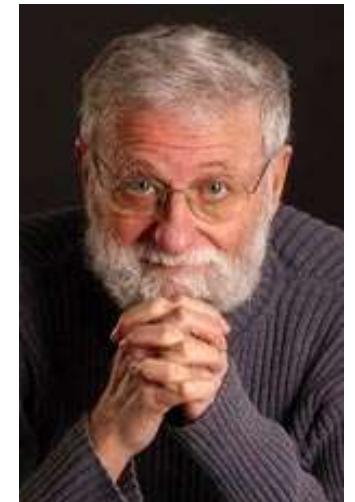
Inventor of UX

The term UX was coined by cognitive scientist Don Norman in the early 1990s while he was working as a Vice President of the Advanced Technology Group at Apple Inc.

— Donald Arthur Norman

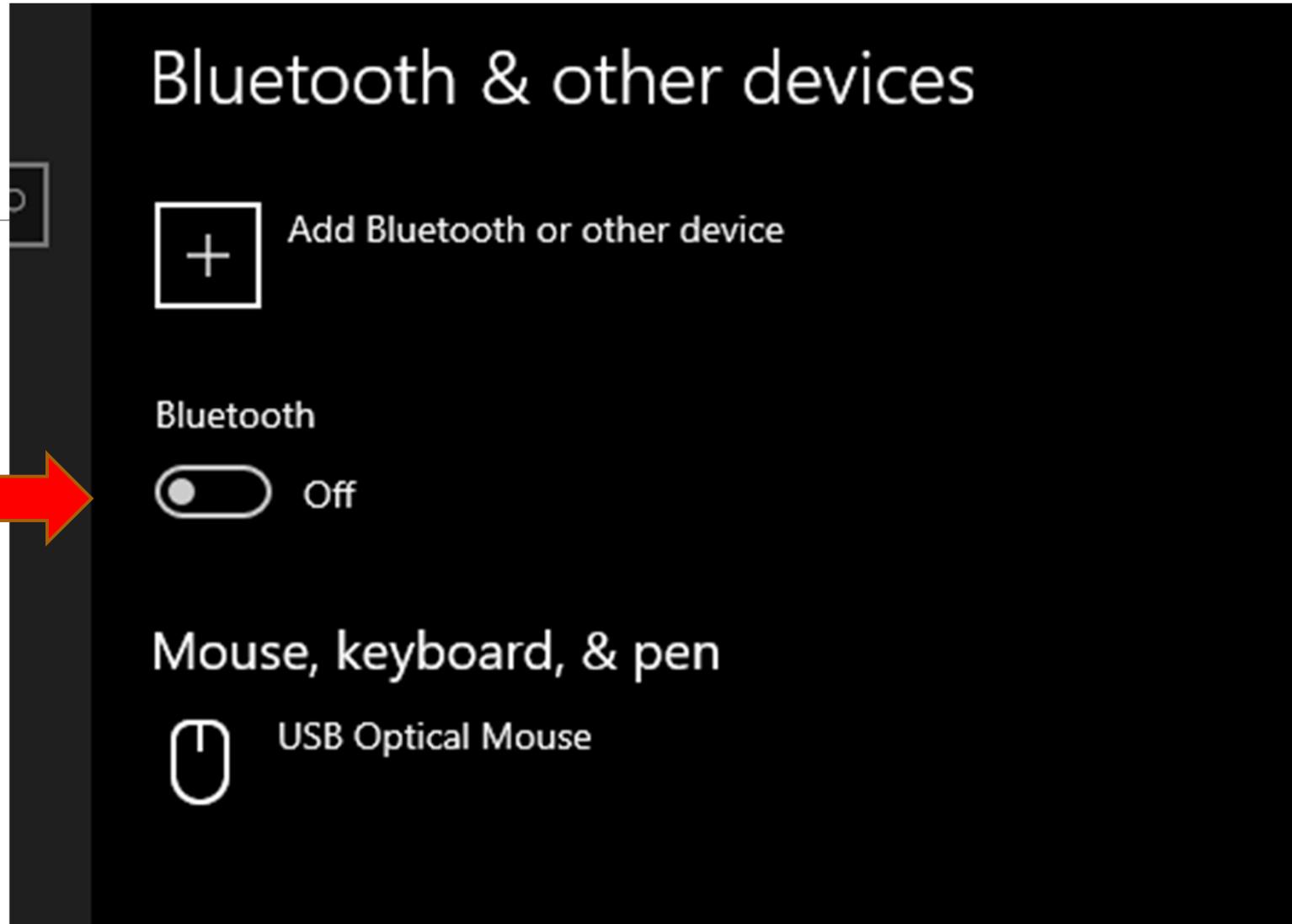
Norman and Interaction

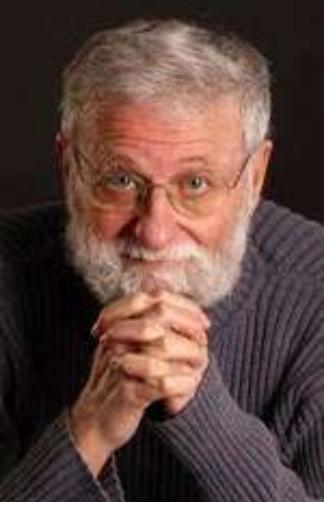
- Based on the user's information processing behavior
- Models the interaction process by dividing it into specific processing levels
- Practical and popular solutions to make existing technologies more usable
- Norman's Motto:
 - “How can we design computer interfaces better so that users with different features can use them in the most comfortable way and get the highest performance”



- A Simple Information Processing Case

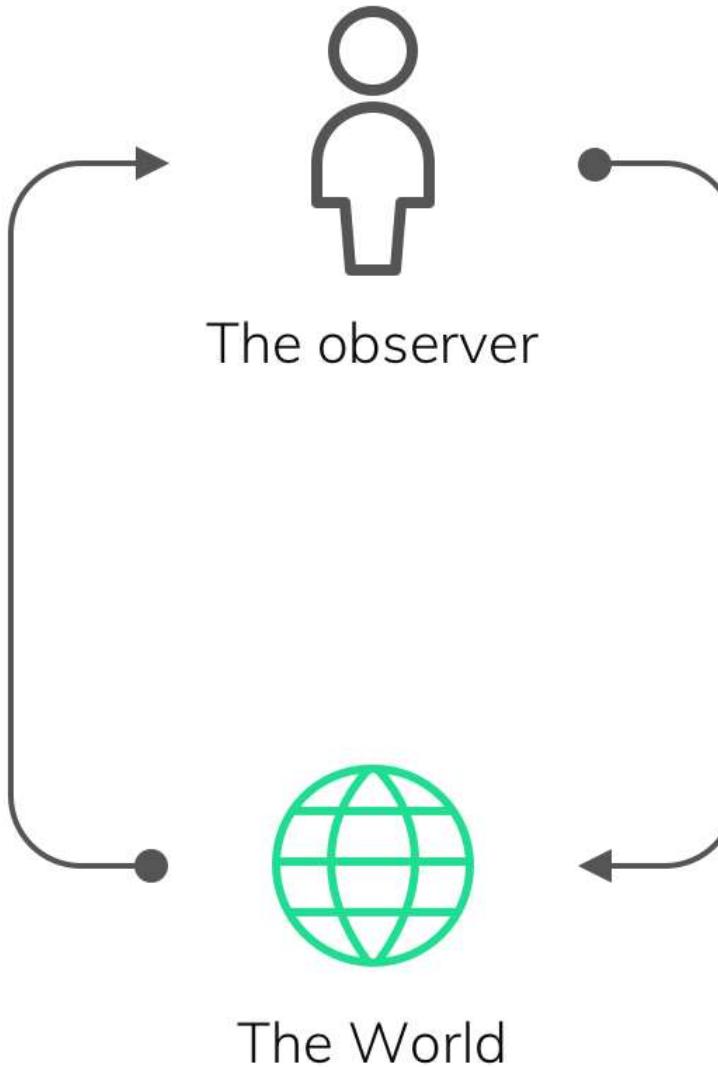
- Is Bluetooth On or Off?





Gulf of Evaluation

What's the current system state?

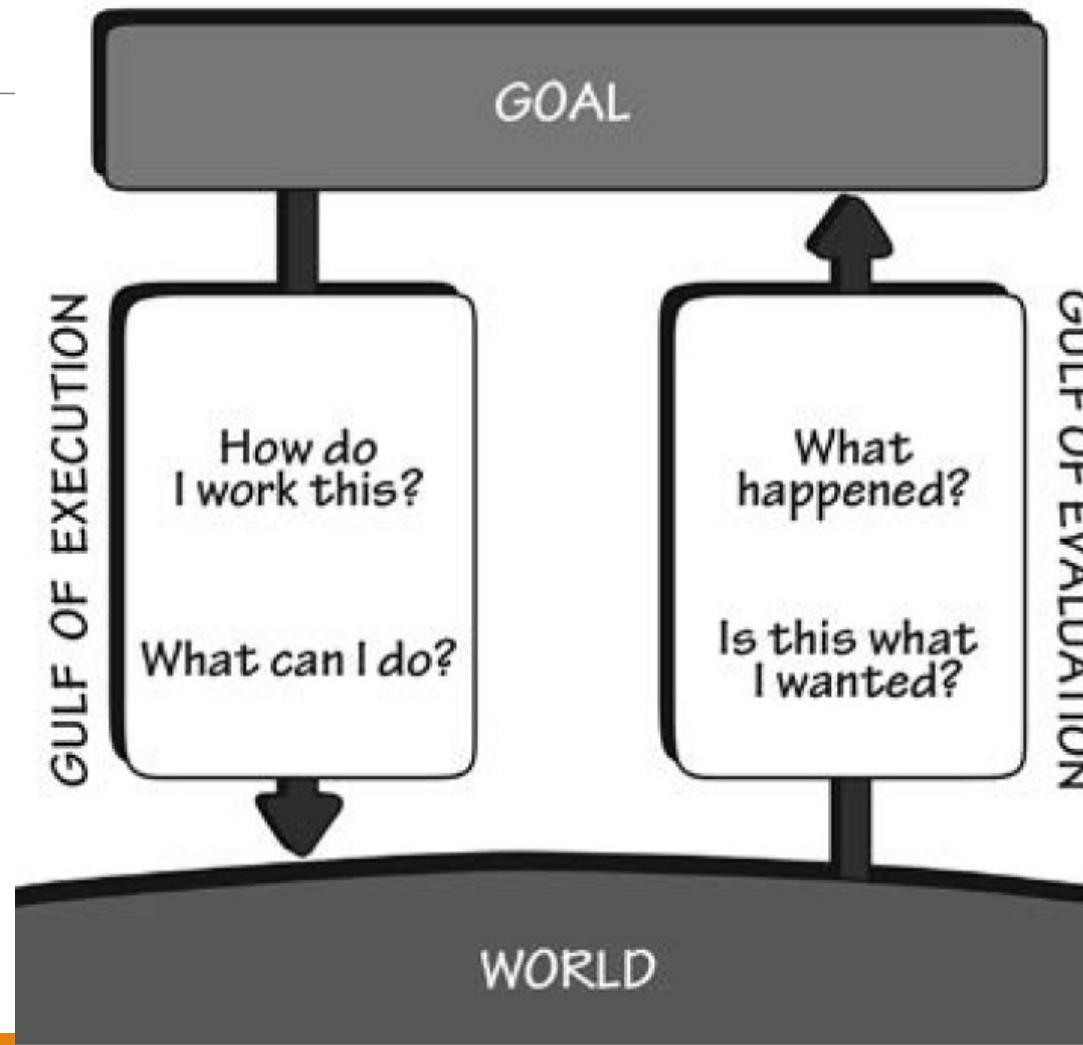


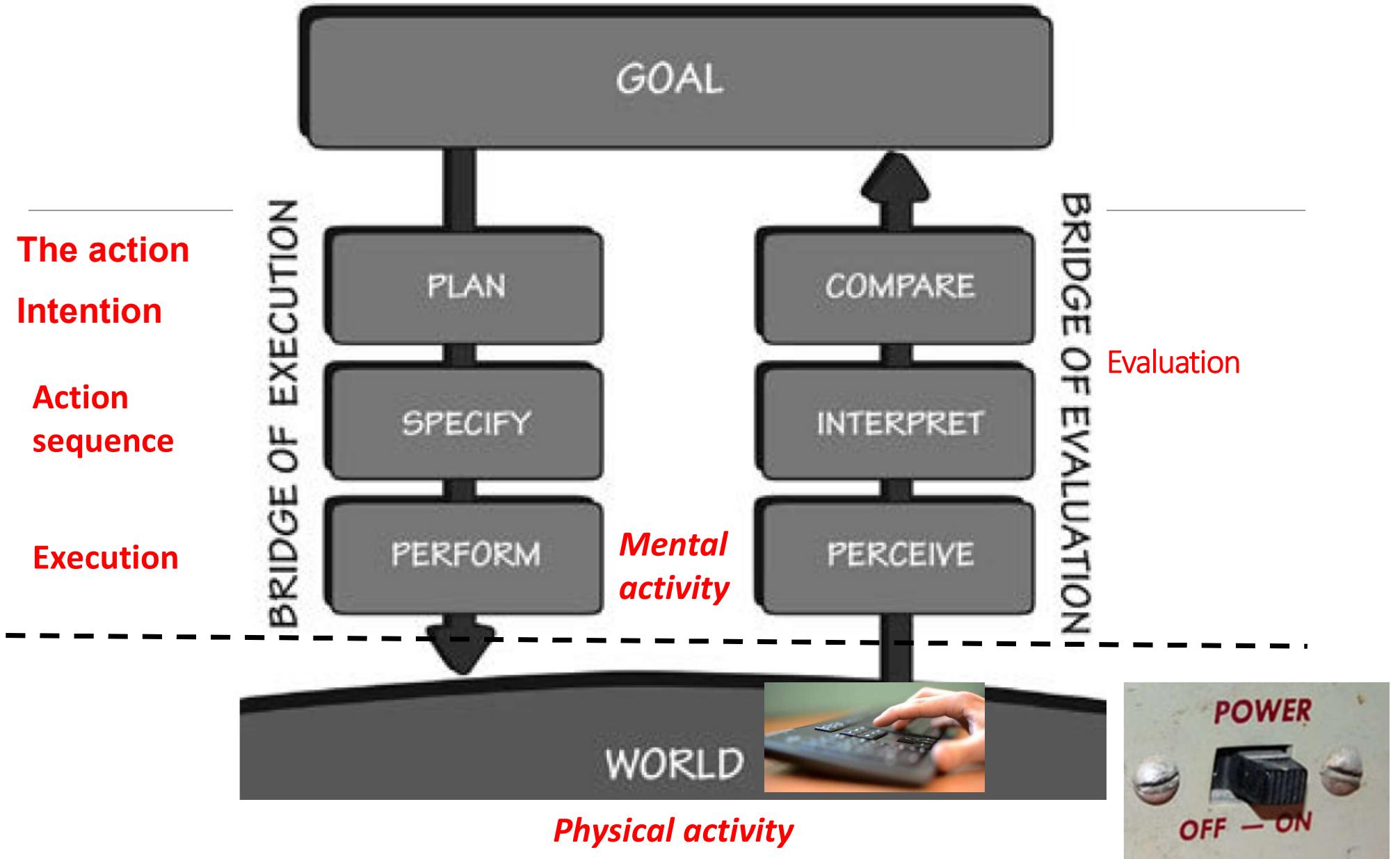
Norman's Metaphore:Gulf



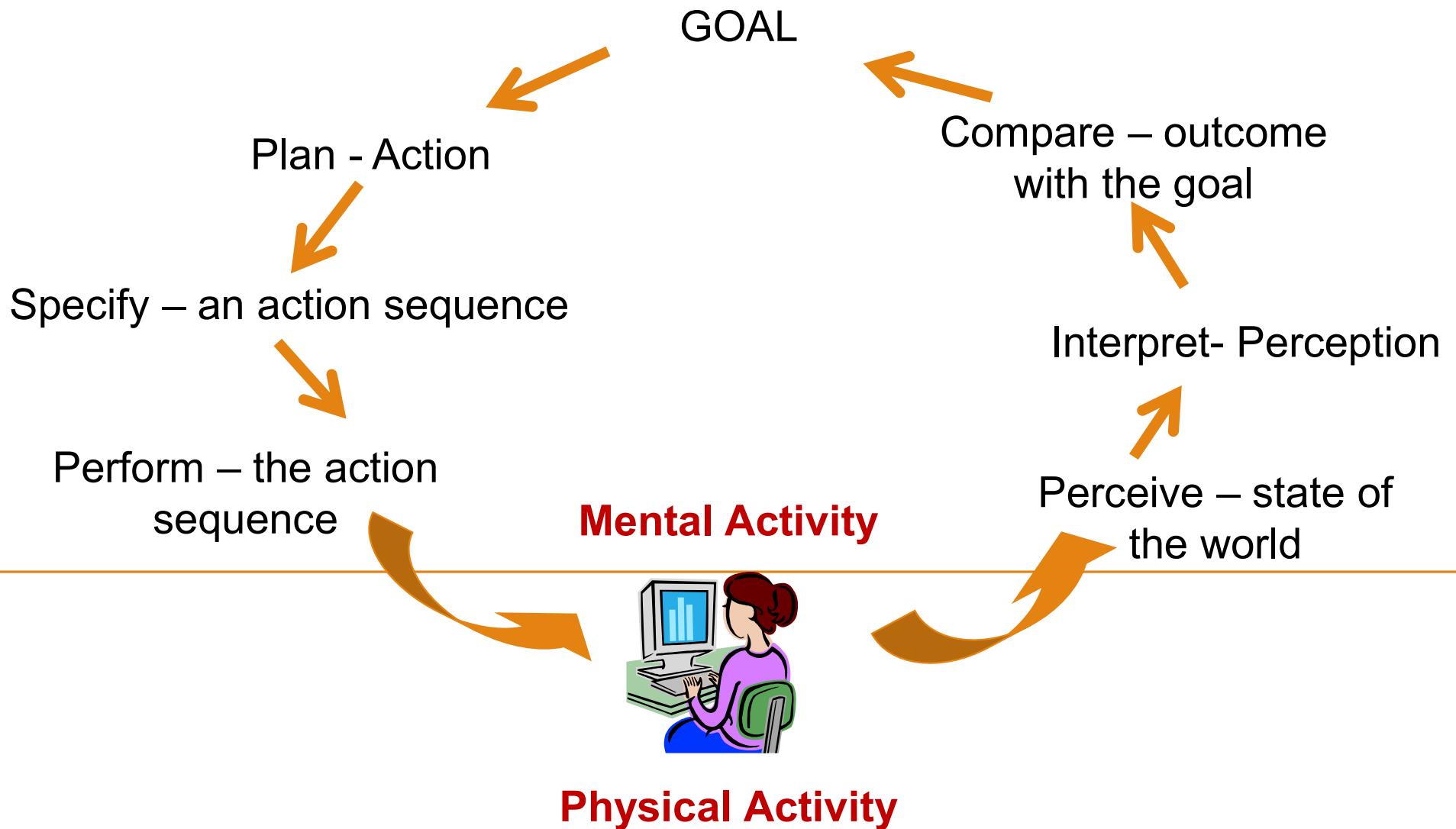
Interaction at high level: Norman's Gulfs

HCI=Bridging the gulfs of execution and evaluation



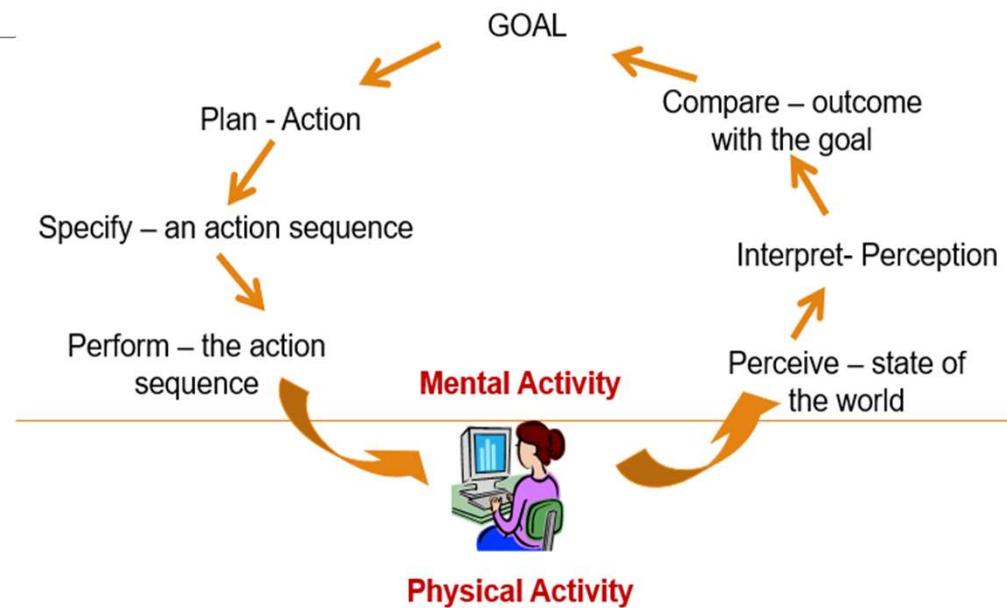


Seven stages of user activities involved in task performance



Norman's 7 Stages

- The user determines the goal and the action to be taken,
- Performs the operation with the interface/tool
- Observes the result; detects and interprets the state of the system,
- Evaluates the result, decides on the next step.



Gaps/ambiguities in this cycle create difficulties and errors

Mental Activity



Physical Activity

Perceive – state of
the world

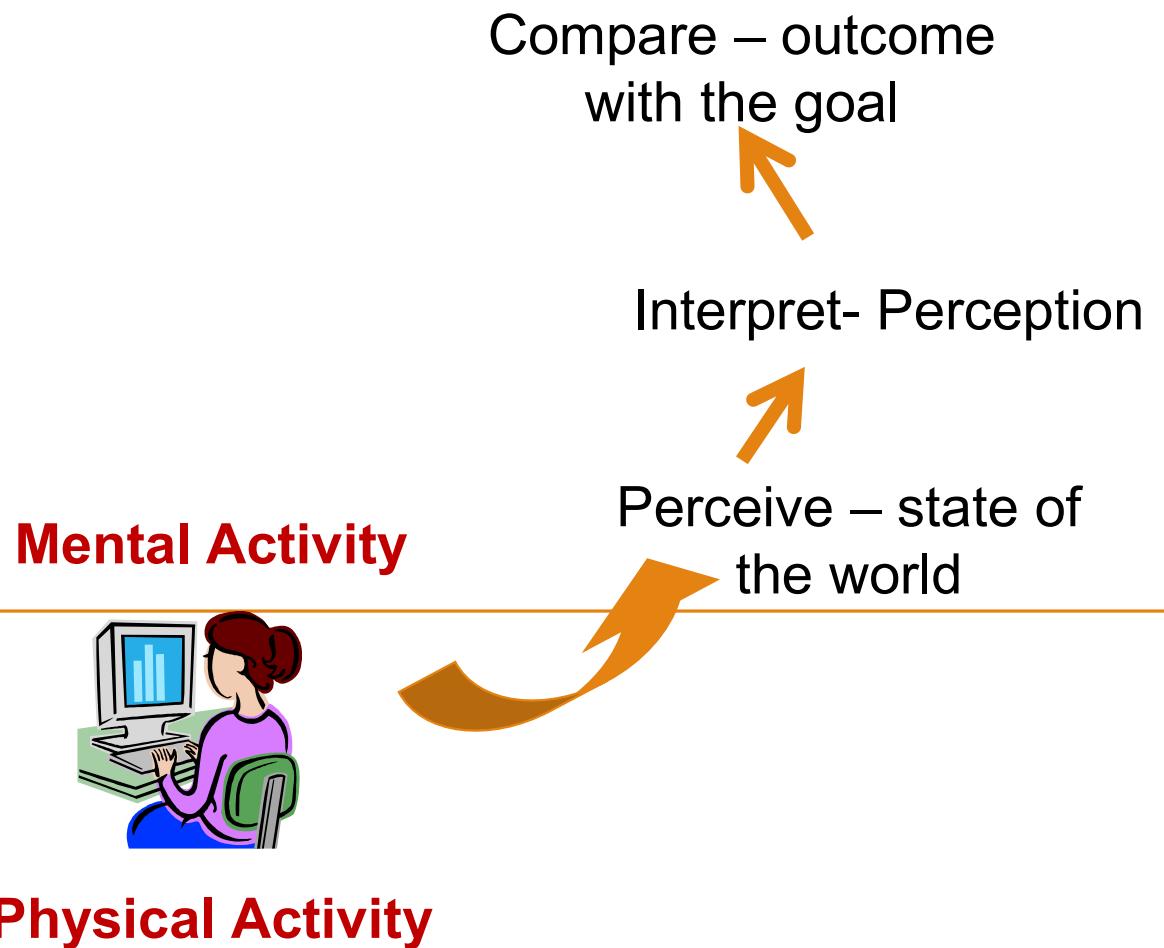
Mental Activity



Physical Activity

Interpret- Perception

Perceive – state of
the world



GOAL



Compare – outcome
with the goal



Interpret- Perception

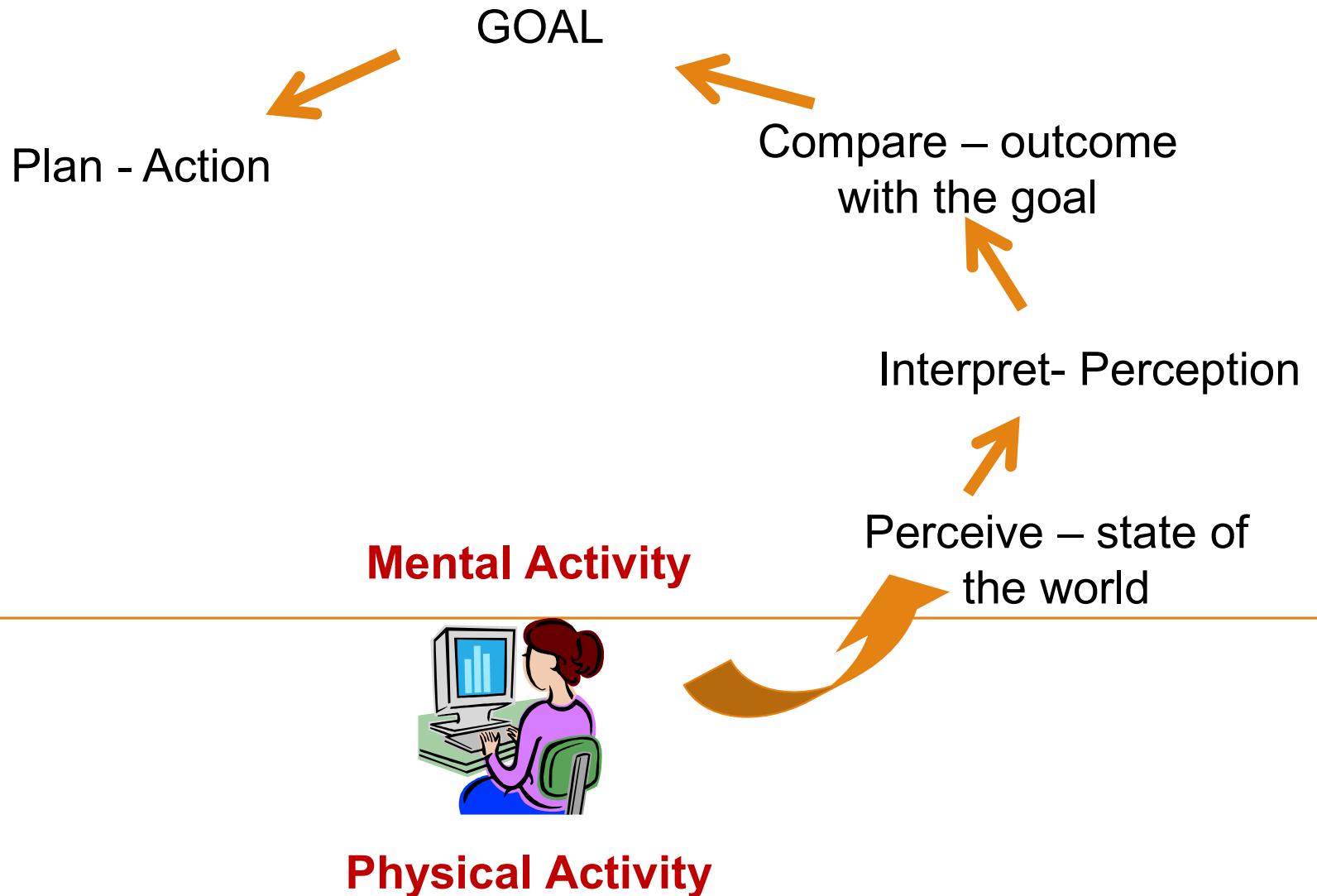


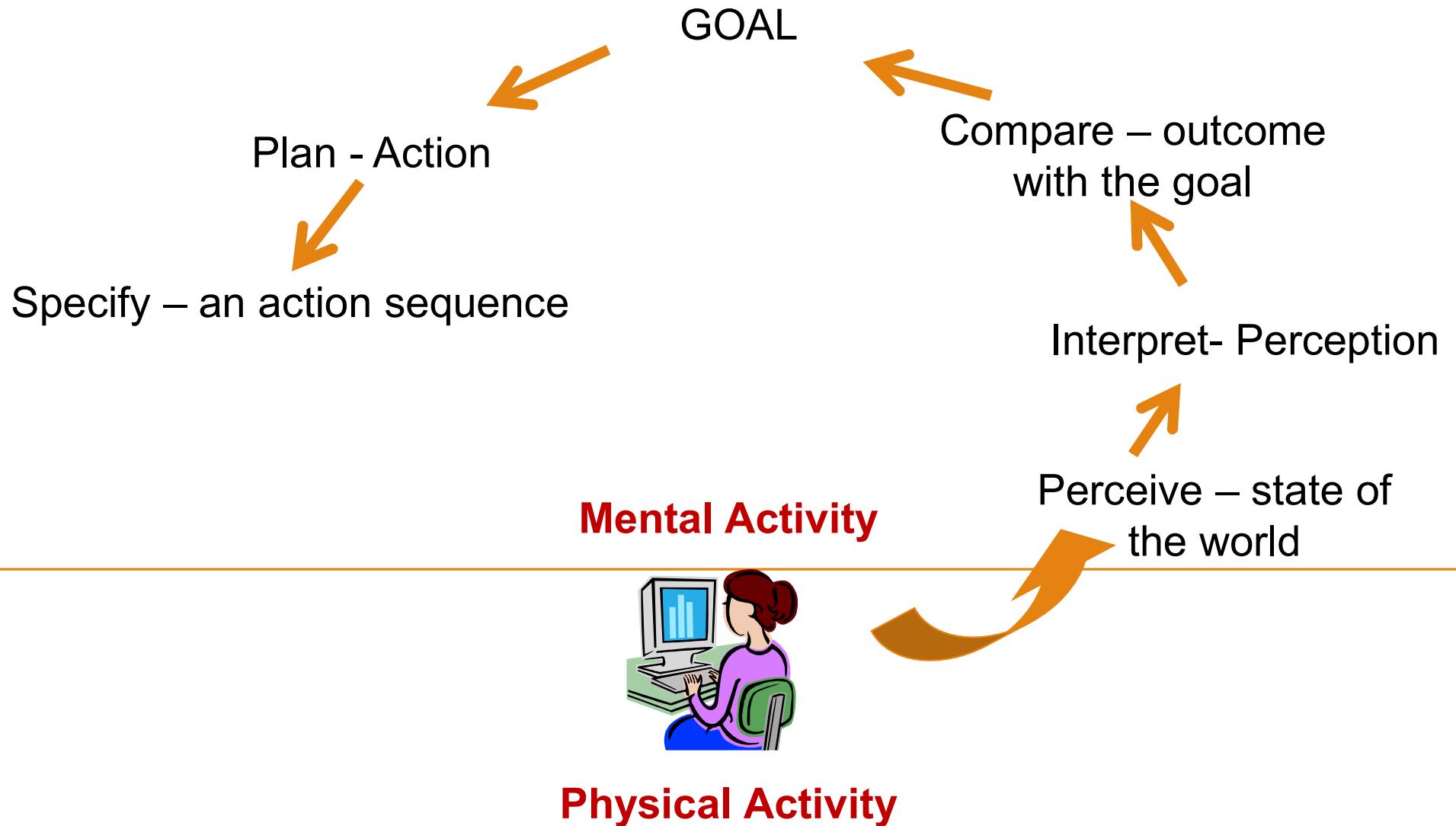
Perceive – state of
the world

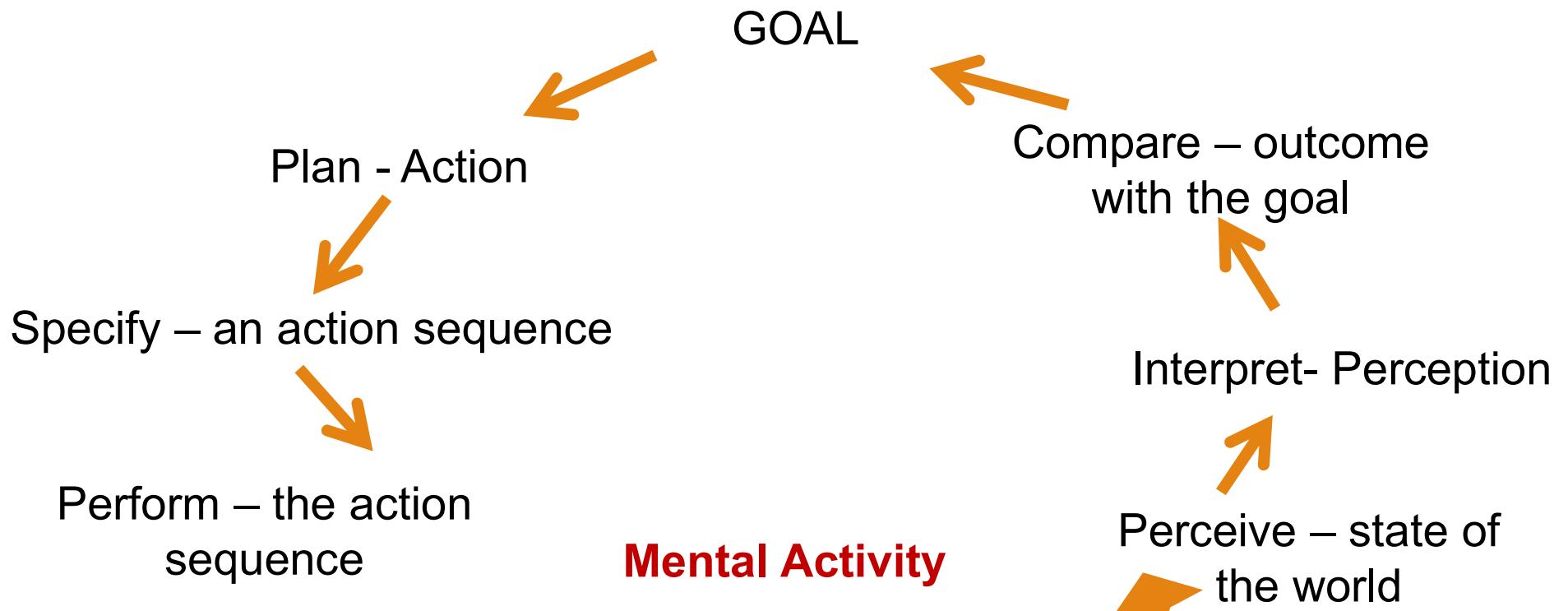
Mental Activity



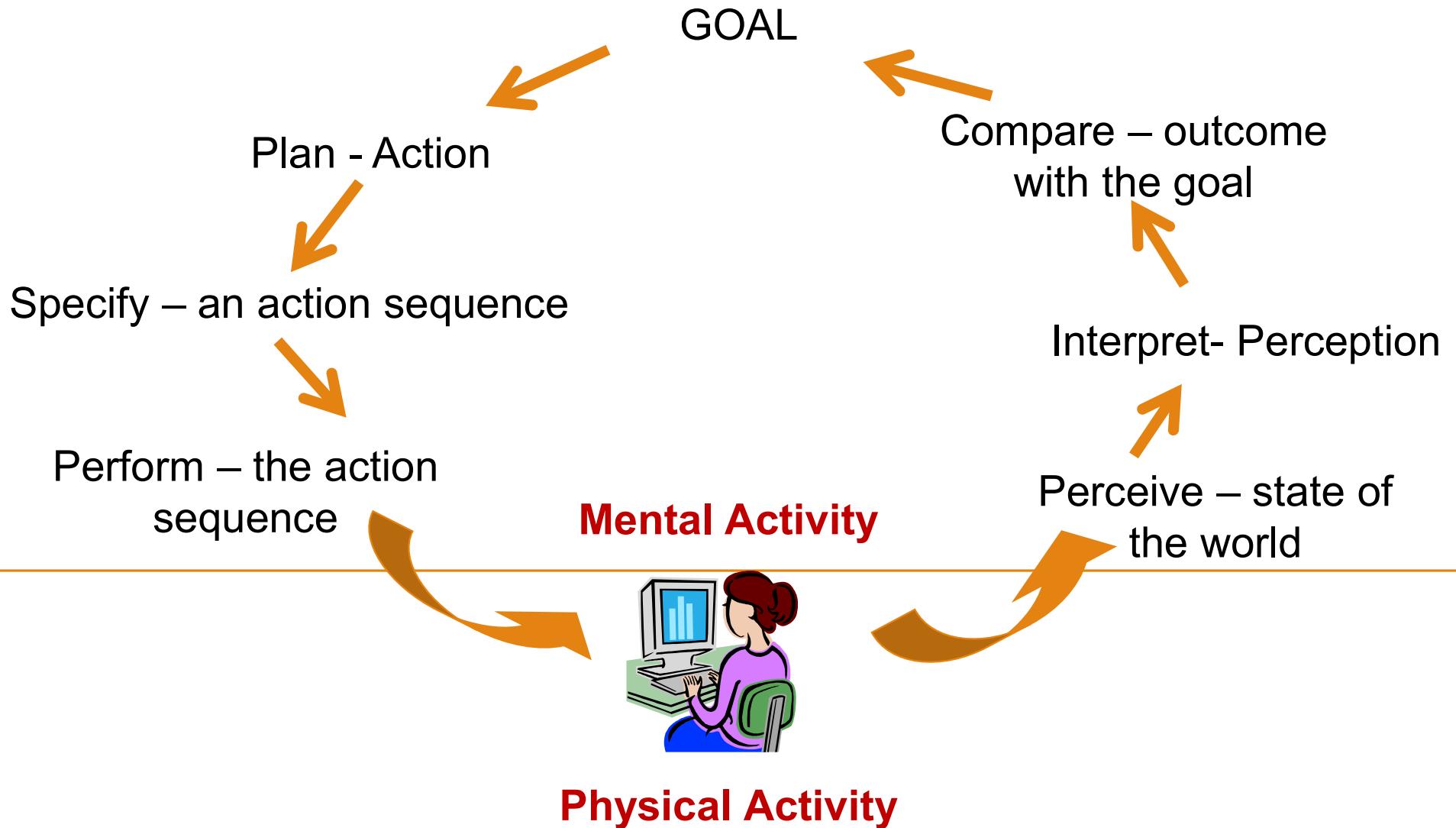
Physical Activity







Physical Activity



- Is Bluetooth On or Off?
- Gulf of? 



Bluetooth & other devices

 Add Bluetooth or other device

Bluetooth

 Off

Mouse, keyboard, & pen

 USB Optical Mouse

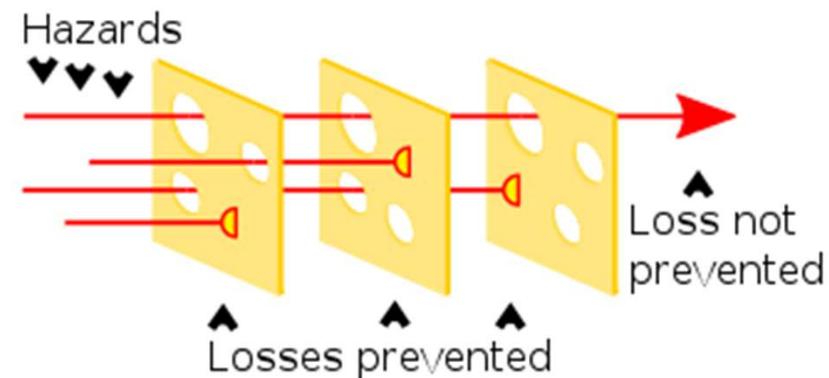
Let's try it: Any volunteer?

Using the seven stage model

- Norman suggest you ask: How easily can a user:
 - | Determine the function of the device?
 - | Determine the mapping from intention to physical movement?
 - | Perform the action?
 - | Tell what state the system is in?
 - | Determine mapping from system state to intention?
 - | Tell if the system is in the desired state?

Norman on Interaction

- Error is a natural part of interaction
- We construct a model from fragmentary evidence
- We turn intentions into physical actions and try to interpret the results
- Events trigger our responses
 - we are embedded in a continuous cycle of interaction with the world



Swiss Cheese Model

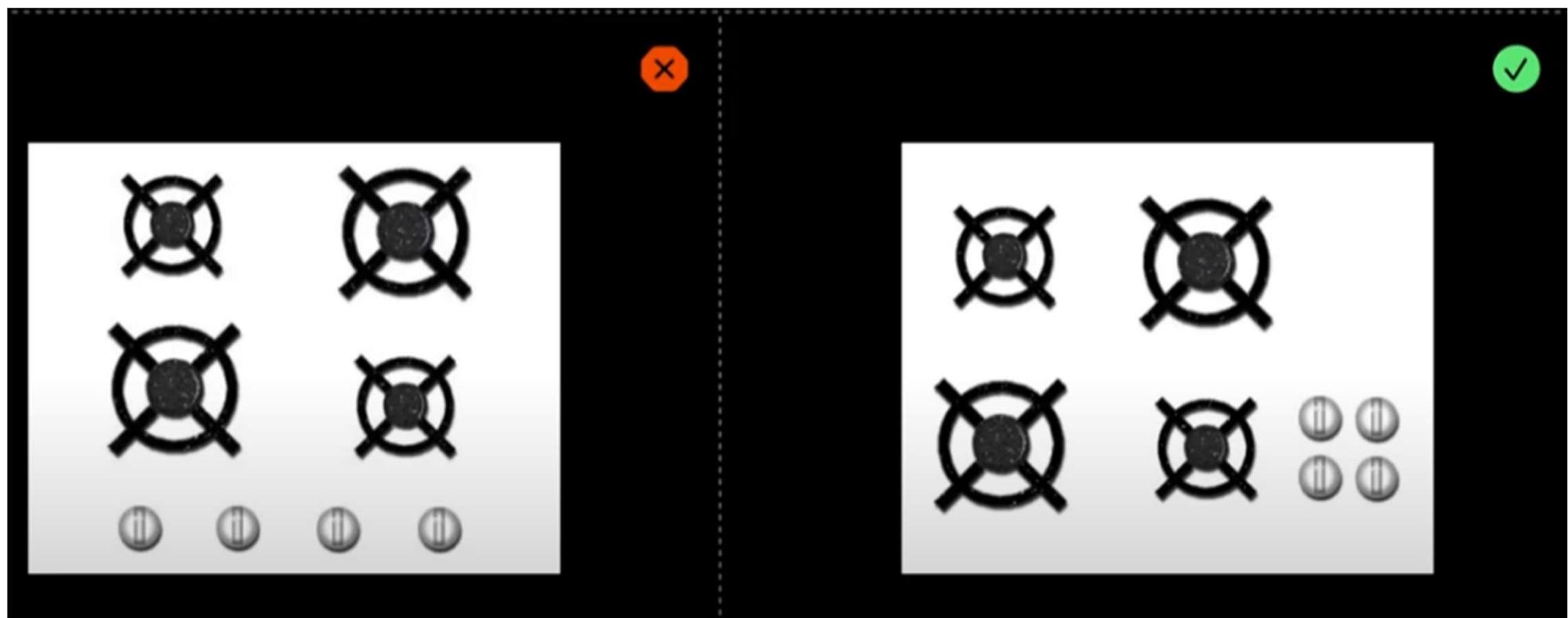
Errors: Users' or Designers'?

- ✗ **Slips:** the goal is correct, but the required actions are not done properly: the execution is flawed. e.g. Click on a button accidentally.
Unconscious
 - ✓ Better screen design
-
- ✗ **Mistake:** occurs when the wrong goal is established or the wrong plan is formed. Conscious
 - ✓ Hard to fix, need to understand the system.

Norman's 7 Principles of Good Design

1. **Discoverability** - State and action alternatives should be **Visible**
2. A **good conceptual model** with a consistent system image
3. **Good mappings** for the relationship between stages
4. Continuous **Feedback**
5. **Affordances** – possible interactions between people and the environment (**Low** - **High**) – Keep a balance
6. **Signifiers** – what actions are possible and how
7. **Constraints** - physical, logical, semantic, and cultural

Mappings?



Gulf?

Evaluation?
Execution?

Errors?



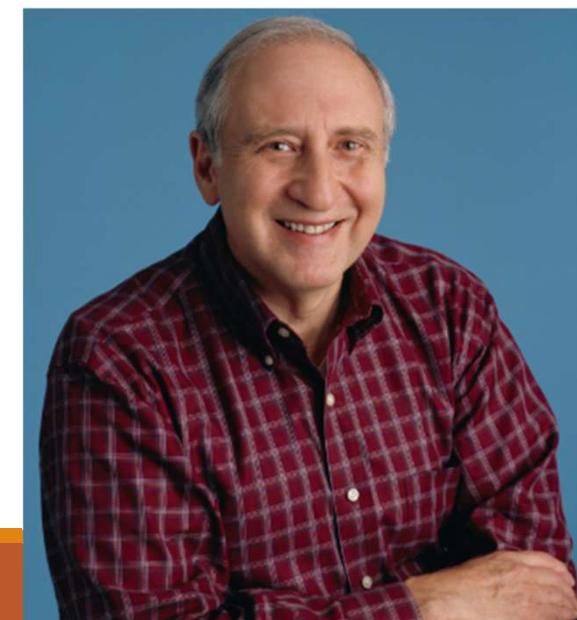
Interaction and Helplessness

- **Learned helplessness**
 - I tried it, I couldn't use it, I give up!
 - I cannot use a computer!
- **Taught helplessness**
 - Like your Math class
 - You cannot do it!

Usability of interactive systems:

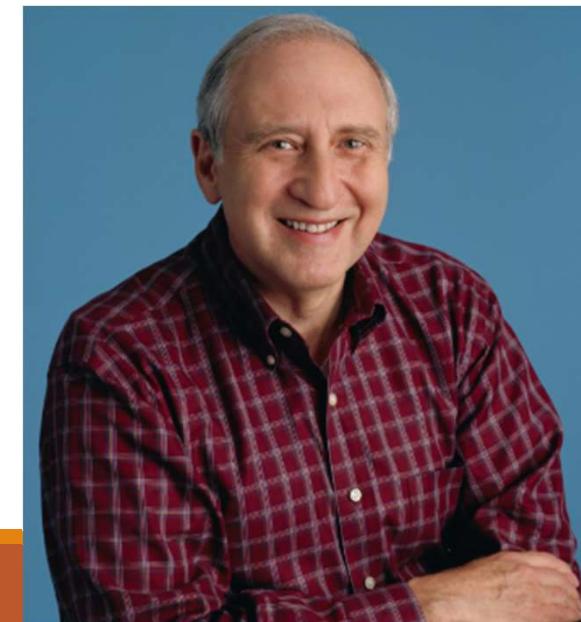
Ben Shneiderman. Reading-4

- Shneiderman is called as the father of HCI. University of Maryland Department of Computer Science
- go beyond vague notions of “user friendliness,” “intuitive”
 - Study evidence-based guidelines
 - Develop principles



Usability of interactive systems: Ben Shneiderman. Ch-1

- Interface should **disappear**, enabling users to concentrate on their work, exploration, or pleasure.
- They are “in the flow”
- Usability Measures
 1. Time to learn
 2. Speed of performance
 3. Rate of errors by users
 4. Retention over time.
 5. Subjective satisfaction



Usability of interactive systems:

Ben Shneiderman. Ch-3 Guidelines, Principles, Theories

1. Guidelines,

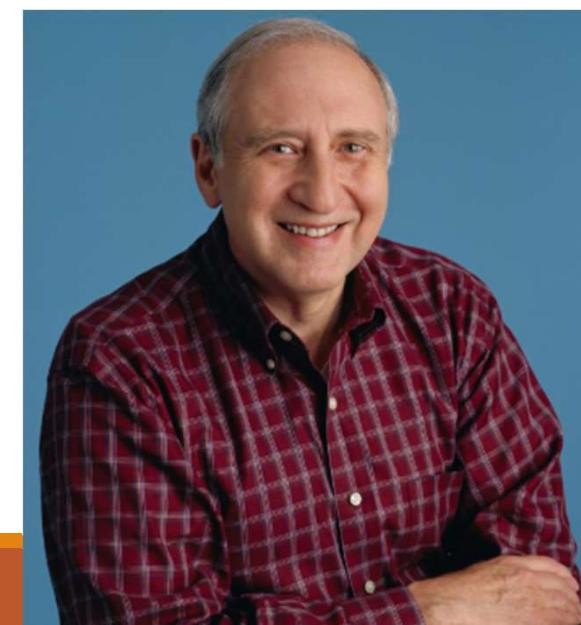
- Low-level focused advice about good practices

2. Principles,

- Middle-level strategies or rules to analyze and compare design alternatives

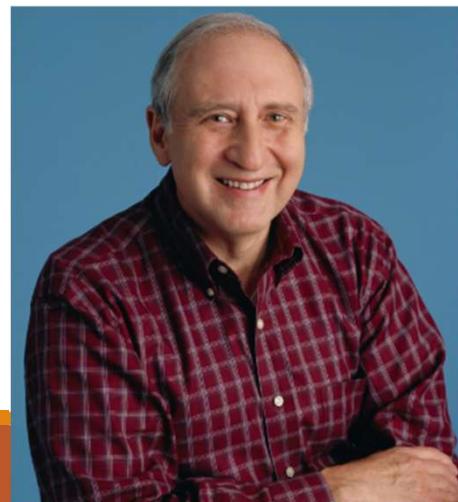
3. Theories

- High-level widely applicable frameworks



1- Guidelines

- Guidelines : Low-level focused advice about good practices
 - best practices derived from practical experience or
 - empirical studies, with appropriate examples and counter examples
- ☹ guidelines can be too specific, incomplete, hard to apply, and sometimes wrong



Apple

Apple Developer News Discover Design Develop Distribute Support Account Q

Design Overview What's new Guidelines Design Awards Videos Resources

Platforms Foundations Patterns Components Inputs Technologies

Human Interface Guidelines

The HIG contains guidance and best practices that can help you design a great experience for any Apple platform.

Featured



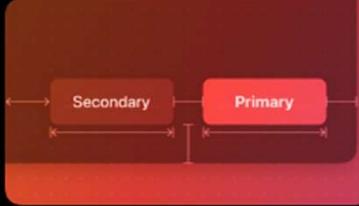
Platforms
Designing for iPadOS



Foundations
Inclusion



Patterns
Onboarding



Components
Buttons



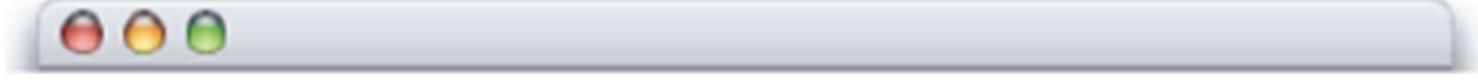
Inputs
Touchscreen gestures



Technologies
Augmented reality

- <https://developer.apple.com/design/human-interface-guidelines/guidelines/overview/> 63

Apple guidelines





Do use "untitled" for the first new window.



Do not capitalize "Untitled".



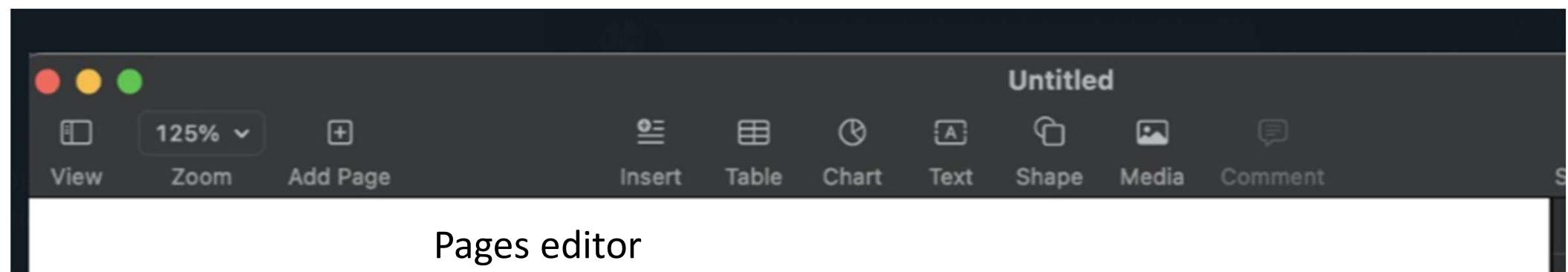
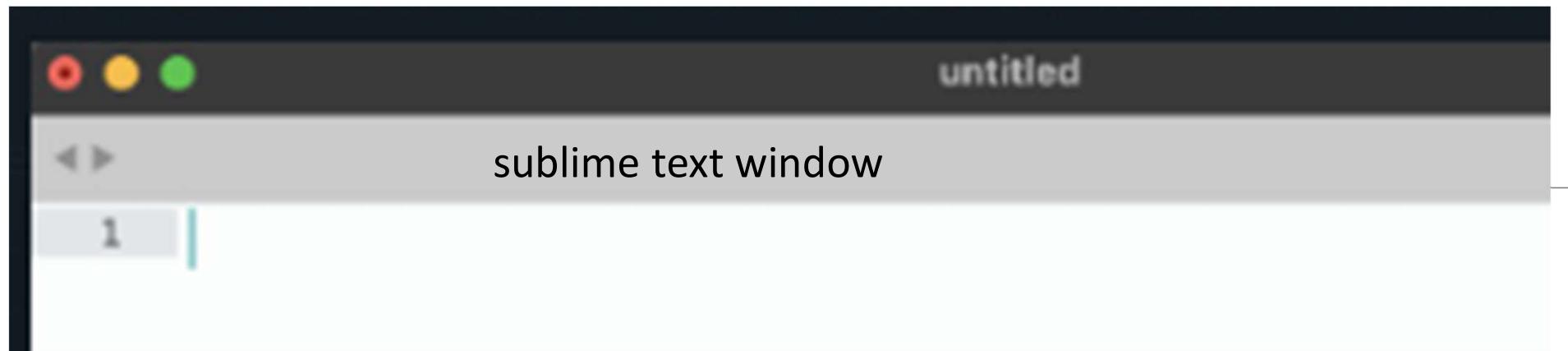
Do not add a number to the first new window.



Do not use additional punctuation.



Do not leave title blank.





User experience guidelines for Universal Windows Platform (UWP) apps

A great app starts with a great user interface. Learn how to design a Universal Windows Platform (UWP) app that looks fantastic on all Windows 10-based devices, from phones and tablets to desktops.

For the online version of these guidelines, see the [Design UWP Apps section](#).

This article contains information that is specific to UWP apps and Windows 10. If you're looking for guidelines for Windows 8.1, please download the [Windows 8.1 guidelines PDF](#).

The screenshot shows a Microsoft Learn page for Windows App Development. The top navigation bar includes links for Microsoft, Learn, Documentation, Training, Certifications, Q&A, Code Samples, Shows, and Events. The main navigation menu under "Windows App Development" includes Explore, Development, Platforms, and Resources. A sidebar on the left provides a "Filter by title" search and a list of topics: Build desktop apps, What's new?, Get started, Setup guides and resources, Design, Develop (with Overview, Build apps with the Windows App SDK, Migrate from UWP to Windows App SDK, Modernize your desktop apps, Optimize performance & fundamentals), and User interface and input (with Overview, Title bar, Apply Mica or Acrylic, Retrieve a window handle (HWND), Display WinRT UI objects that depend on CoreWindow, and Windows UI Library (WinUI)). The main content area features the "User interface and input" article, which is an overview of Windows UI frameworks. It includes a brief history, a comparison of frameworks like WinUI, WPF, and WinForms, and details about modernizing desktop apps. The article is dated 09/03/2022, has a reading time of 6 minutes, and 6 contributors. Below the article, there is a section titled "User interface fundamentals" and a note about the five main components of a user interface.

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Windows App Development Explore Development Platforms Resources

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> Build apps with the Windows App SDK

> Migrate from UWP to Windows App SDK

> Modernize your desktop apps

> Optimize performance & fundamentals

User interface and input

Overview

Title bar

Apply Mica or Acrylic

Retrieve a window handle (HWND)

Display WinRT UI objects that depend on CoreWindow

> Windows UI Library (WinUI)

Learn / Windows / Apps / Desktop / Develop /

User interface and input

Article • 09/03/2022 • 6 minutes to read • 6 contributors

This article provides an overview of the Windows UI frameworks that are currently maintained by Microsoft and compares their capabilities.

Microsoft produces both UI frameworks and app platforms. App platforms typically include a UI framework, while UI frameworks are either standalone (not shipped with an app platform) or can be used with multiple app platforms (see [Choose your app platform](#)).

The frameworks discussed here include the Windows UI Library (WinUI) for both Windows App SDK (WinUI 3) and UWP (WinUI 2), Windows Presentation Foundation (WPF), and Windows Forms (WinForms).

User interface fundamentals

When building a modern Windows app, you have a selection of UI frameworks to choose from. UI frameworks provide your app with built in controls, styles, animations, input handling, and more.

There are five main components that go into creating a user interface for your Windows app. These components are usually built into each UI framework.

- <https://go.microsoft.com/fwlink/?LinkId=626098>

 type your e-mail address in the format `yourname@example.com`.



Windows Live ID:

(`example555@hotmail.com`)

 type your password.

Password:

[Forgot your password?](#)

 Please type your e-mail address in the format `yourname@example.com`.



Windows Live ID:

(`example555@hotmail.com`)

 Please type your password.

Password:

[Forgot your password?](#)